CLAIMS

1. An expanded porous polytetrafluoroethylene film having a microstructure composed of fine fibrils and nodes connected by the fibrils and elastic recovery property in its thickness-wise direction, wherein the film has residual strain of at most 11.0% as measured after a load required to indent a rod, which is in a columnar form that its outer diameter is at least 2 mm and at least 1.9 times as much as the thickness of the film, and has a smooth plane perpendicular to its axis at a free end surface thereof and a modulus of longitudinal elasticity of at least 1.0×10^4 kgf/mm^2, up to 20% of the film thickness at a strain rate of 100%/min from the free end surface is applied repeatedly 20 times.

2. The expanded porous polytetrafluoroethylene film according to claim 1, wherein a variation of tangent modulus is at most 10.0%.

3. The expanded porous polytetrafluoroethylene film according to claim 1, wherein residual strain is at most 10.5, and a variation of tangent modulus is at most 7.0%.

4. The expanded porous polytetrafluoroethylene film according to claim 1, wherein residual strain is at most 6.5, and a variation of tangent modulus is at most 7.0%.

5. A process for producing an expanded porous polytetrafluoroethylene film having a microstructure composed of fine fibrils and nodes connected by the fibrils, the process comprising the following steps 1 to 6:

(1) an extrusion step 1 of extruding a mixture of unsintered polytetrafluoroethylene powder and a lubricant to prepare an extrudate in the form of a sheet or rod;

(2) a rolling step 2 of rolling the extrudate to prepare a rolled sheet;

(3) a stretching step 3 of biaxially stretching the rolled sheet in lengthwise and crosswise directions at a total draw ratio exceeding 12 times to prepare an expanded porous polytetrafluoroethylene film (A);

(4) a sintering step 4 of heating the expanded porous polytetrafluoroethylene film (A) to a temperature not lower than the melting point of polytetrafluoroethylene in a state fixed so as not to shrink the film to sinter the film;

(5) a cooling step 5 of cooling the sintered expanded porous polytetrafluoroethylene film (A); and

(6) a compression step 6 of compressing the cooled expanded porous polytetrafluoroethylene film (A) in a thickness-wise direction of the film,

thereby obtaining an expanded porous polytetrafluoroethylene film (B) having elastic recovery property in the thickness-wise direction of the film.

6. The production process according to claim 5, wherein in the rolling step 2, a sheet-like extrudate is rolled to a rolling ratio of at least 1.3 times.

7. The production process according to claim 5, wherein in the stretching step 3, the rolled sheet is biaxially stretched in such a manner that the total draw ratio is at least 20 times.

8. The production process according to claim 5, wherein in the sintering step 4, an expanded porous polytetrafluoroethylene film (A) having a porosity of at least 66% is prepared.

9. The production process according to claim 5, wherein in the cooling step 5, the sintered expanded porous polytetrafluoroethylene film (A) is air-cooled at ambient temperature or quenched by blowing a cooling medium against the film.

10. The production process according to claim 5, wherein in the compression step 6, the expanded porous polytetrafluoroethylene film (A) is compressed at a compression ratio of 1.1 to 4.0.

11. The production process according to claim 5, wherein after the compression step 6, a expanded porous

polytetrafluoroethylene film (B) having a porosity of 40 to 75% is obtained.

12. The production process according to claim 5, wherein after the compression step 6, an expanded porous polytetrafluoroethylene film (B) having residual strain of at most 11.0% as measured after a load required to indent a rod, which is in a columnar form that its outer diameter is at least 2 mm and at least 1.9 times as much as the thickness of the film, and has a smooth plane perpendicular to its axis at a free end surface thereof and a modulus of longitudinal elasticity of at least 1.0×10^4 kgf/mm^2, up to 20% of the film thickness at a strain rate of 100%/min from the free end surface is applied repeatedly 20 times is obtained.

13. A process for producing an expanded porous polytetrafluoroethylene film having a microstructure composed of fine fibrils and nodes connected by the fibrils, the process comprising the following steps I to VII:

(1) an extrusion step I of extruding a mixture of unsintered polytetrafluoroethylene powder and a lubricant to prepare an extrudate in the form of a sheet or rod;

(2) a rolling step II of rolling the extrudate to prepare a rolled sheet;

(3) a stretching step III of biaxially stretching the rolled sheet in lengthwise and crosswise directions at a

total draw ratio exceeding 12 times to prepare an expanded porous polytetrafluoroethylene film (A);

(4) a multi-layer film-forming step IV of laminating at least two expanded porous polytetrafluoroethylene films (A) to prepare a multi-layer film (A1);

(5) a sintering step V of heating the multi-layer film (A1) to a temperature not lower than the melting point of polytetrafluoroethylene in a state fixed so as not to shrink all the layers to sinter the film, and at the same time integrally fusion-bond the respective layers to each other to prepare an expanded porous polytetrafluoroethylene film (A2);

(6) a cooling step VI of cooling the sintered expanded porous polytetrafluoroethylene film (A2); and

(7) a compression step VII of compressing the cooled expanded porous polytetrafluoroethylene film (A2) in a thickness-wise direction of the film,

thereby obtaining an expanded porous polytetrafluoroethylene film (B1) having elastic recovery property in the thickness-wise direction of the film.

14. The production process according to claim 13, wherein in the rolling step II, a sheet-like extrudate is rolled to a rolling ratio of at least 1.3 times.

15. The production process according to claim 13, wherein in the stretching step III, the rolled sheet is

biaxially stretched in such a manner that the total draw ratio is at least 20 times.

16. The production process according to claim 13, wherein in the sintering step V, an expanded porous polytetrafluoroethylene film (A2) having a porosity of at least 66% is prepared.

17. The production process according to claim 13, wherein in the cooling step VI, the sintered expanded porous polytetrafluoroethylene film (A2) is air-cooled at ambient temperature or quenched by blowing a cooling medium against the film.

18. The production process according to claim 13, wherein in the compression step VII, the expanded porous polytetrafluoroethylene film (A2) is compressed at a compression ratio of 1.1 to 4.0.

19. The production process according to claim 13, wherein after the compression step VII, an expanded porous polytetrafluoroethylene film (B1) having a porosity of 40 to 75% is obtained.

20. The production process according to claim 13, wherein after the compression step VII, an expanded porous polytetrafluoroethylene film (B1) having residual strain of

at most 11.0% as measured after a load required to indent a rod, which is in a columnar form that its outer diameter is at least 2 mm and at least 1.9 times as much as the thickness of the film, and has a smooth plane perpendicular to its axis at a free end surface thereof and a modulus of longitudinal elasticity of at least 1.0×10^4 kgf/mm^2, up to 20% of the film thickness at a strain rate of 100%/min from the free end surface is applied repeatedly 20 times is obtained.

21. Anisotropically conductive film having a structure that a plurality of through-holes are formed in the expanded porous polytetrafluoroethylene film according to any one of claims 1 to 4, and a conductive metal is applied to wall surfaces of the respective through-holes.

22. A cushioning material comprising the expanded porous polytetrafluoroethylene film according to any one of claims 1 to 4.

23. A sealing material comprising the expanded porous polytetrafluoroethylene film according to any one of claims 1 to 4.

24. An intracorporeally implanting material comprising the expanded porous polytetrafluoroethylene film according to any one of claims 1 to 4.